

HYLAMBATES JOHNSTONI, sp. n. (Plate XLVI. fig. 4.)

Vomerine teeth in two small groups between the choanæ. Head much broader than long; snout rounded, as long as the diameter of the eye; interorbital space as broad as the upper eyelid; tympanum two thirds the diameter of the eye. Fingers with a slight rudiment of web; toes half-webbed; disks well developed; inner metatarsal tubercle large, compressed, crescentic, very prominent. The tibio-tarsal articulation reaches the eye. Skin smooth above, granulate on the throat, belly, and lower surface of thighs. Purplish or brown above, with a more or less distinct dark triangular marking on the back, the apex reaching the occiput; white dots usually scattered on the back; limbs with very indistinct dark cross-bars; a white streak borders the upper lip, the outer side of the forearm and hand, the anal region, the heel, and the outer side of the foot; hinder side of thighs dark brown; lower parts white.

From snout to vent 42 millim.

Closely allied to *H. anchietæ*, Bocage, from Angola.

Three specimens from Kondowe-Karonga, and one from the Nyika Plateau.

EXPLANATION OF PLATE XLVI.

- Fig. 1. *Lygosoma johnstoni*, Blgr. Side views of head and anterior portion of body and pelvic region, and upper view of head (p. 801).
 2. *Glypholycus whytii*, Blgr. Upper, lower, and side views of head (p. 802).
 3. *Arthroleptis whytii*, Blgr (p. 802).
 4. *Hylambates johnstoni*, Blgr (p. 803).

9. Contributions to our Knowledge of the Plankton of the Faeroe Channel.—No. III.¹ The Later Development of *Arachnactis albida* (M. Sars), with Notes on *Arachnactis bournei* (sp. n.). By G. HERBERT FOWLER, B.A., Ph.D., Assistant Professor of Zoology, University College, London.

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(Plate XLVII.)

ARACHNACTIS ALBIDA (M. Sars).

This beautiful floating Actinian was originally described by Michael Sars in 1846 (*loc. cit. infra*); it has since been taken on several occasions, and has received quite a large amount of attention.

The recorded occurrences and the references to descriptions are most simply put in tabular form. They all refer to surface captures, often in company with shoals of *Salpæ*.

¹ For Part I. see P. Z. S. 1896, p. 991; Part II, *antea*, p. 523.

Arachnactis albida, M. Sars.

M. Sars, Fauna littor. Norveg. i. p. 28.	Off Florøe Island.	Autumn & winter, 1846.	Original description of the species.
Forbes & Goodsir, Tr. Roy. Soc. Edin. xx. 307.	The Minch.	Aug. 1850.	Refer to Dr. Balfour having taken it in 1841.
Vogt, Archives de Biologie, viii. p. 1.	56° 35' N., 20° 19' W.	Sept. 1861.	In strong current from N.E.
" " "	Rockall to Hebrides ('Holsatia').	July 1885.	
Boveri, Zeit. wiss. Zool. xlix. p. 459.	Faeroe Channel ('Triton').	Aug. 1882.	
Vanhöffen, Bibliotheca Zoologica, Hft. xx.	60° N., 7° W.	Sept. 1893.	
" " "	? Rockall to Hebrides ('National').	1889.	German Plankton Exped.
" " "	North Sea, near Brit. coasts.	Feb. to April, 1895.	? <i>A. bourncei</i> .
Browne (unpublished).	Valentia Island.	{ Mar. 1895.	
Fowler	Faeroe Channel ('Research').	{ Aug. 1896.	
		{ July 1897.	

All recent observers of *Arachnactis* are agreed that it is to be referred to the *Cerianthide*. As regards the early development of this group, Kowalevsky¹ traced it from the gastrulation to the formation of two pairs of tentacles and one pair of mesenteries; but unfortunately obscured his information by writing in Russian. Van Beneden², beginning where Kowalevsky left off (and giving a short abstract of his work), traced the development of an *Arachnactis* (apparently not *A. albida*, although described under that name) from a stage with two pairs of tentacles and one of mesenteries up to a stage with seven tentacles and four pairs of mesenteries. On the later development we have also two papers: Boveri³ began with 8 tentacles and five pairs of mesenteries, and carried it to a stage with 21 tentacles and 14 oral tentacles; Vanhöffen⁴ made sections of, and described in detail, a stage with 19 mesenteries.

As regards these two last papers, I am glad to say that my observations bear out those of Boveri, but regret that they are far from agreement with those of Vanhöffen. The latter author has been drawn into a series of mistakes by an initial error, which is best given in his own words:—"Die Reihenfolge in der Bildung der Septen ergibt sich aus der Verfolgung der Schnitte von unten nach oben"; that is to say, he imagines that the order of development of the mesenteries can be inferred from a comparison of their absolute length at a late stage: and it is hardly necessary to say, not only that this assumption is quite unjustifiable, but that the order of development which he consequently assigns to the mesenteries proves to be absolutely erroneous when tested by successive stages. As Vanhöffen is the latest writer on *Arachnactis*,

¹ Nachrichten d. Ges. d. Freunde d. Naturerkenntniss u. s. w., Moscow, 1873.

² Archives de Biologie, xi. p. 115. ³ *Op. cit. supra*. ⁴ *Op. cit. supra*.

it seemed to me worth while to study all the stages in my power, and to endeavour to put the matter straight again.

The following stages have been drawn from 'Research' specimens and cut into microscopic sections:—

Stage.	Tentacles.	Mesenteries.	Oral tentacles.
A	6	10	0
B	7	11	4
Appearance of the unpaired tentacle (5).			
C	9	12	4
D	9	12	4
E	10	14	6
F	11	16	8
G	12	16	8
H	13	18	8
I	?	19	10

(First appearance of generative cells.)

A few older stages have also been studied.

This table, taken together with the diagram (Pl. XLVII. fig. 1), sufficiently shows the successive development of the various structures, and their position in the oldest specimens. As regards this diagram, the order of succession of the first four pairs of mesenteries is taken from van Beneden's account of an allied species, and that of the first two pairs of tentacles is inferred from his drawings and descriptions. The facts implied by the remainder of the diagram I have myself checked, and they will be found to differ entirely from those given by Vanhöffen, and to agree with those of Boveri on all points with which we both deal. The developmental order of the first four pairs of mesenteries, as described by van Beneden (*c*, *a*, *b*, *d*), appeared at first to contradict the lettering attached to the same mesenteries by Boveri (*d*, *a*, *b*, *c*), but the latter author courteously informs me that he did not intend by these letters to indicate a developmental succession: van Beneden's observed order may therefore be taken to hold good for this species also, in default of direct evidence.

ARACHNACTIS BOURNET, sp. n.

There can be no doubt that the specimens from the English Channel, first recorded by Bourne, and described by van Beneden, under the name of *Arachnactis albida*, belong to another and an unnamed species. Not only are the form and proportions of the animal quite different from those of *albida*, both in van Beneden's drawings and in a few specimens which I received from the Marine Biological Station at Plymouth in 1893, but also the rate at which different sets of organs are developed is not the same in the two species. This is at once apparent on a comparison of my table of *albida* stages (given above) with the following:—

	Tentacles.	Mesenteries.	Oral tentacles.
Van Beneden's oldest larva ..	7	8	0 —
Plymouth specimens (1893) ..	9	10	2

and while the Plymouth specimens acquire the characteristic terminal pore at a stage of between 7 and 9 tentacles, it does not become perforated in *albida* until a stage of about 8 mm. in length provided with 12 oral tentacles, or, according to Boveri, 17 marginal tentacles.

Until this Channel form be traced to a known adult Cerianthid (?*C. Lloydii*, Gosse), I propose to distinguish it from *A. albida* by associating with it the name of my friend Mr. G. C. Bourne, the first Director of the Plymouth Station, under the style of *Arachnactis bournei*; for although I admit that the christening of larvæ by specific names is a reprehensible practice, still so much tow-netting is now carried out every summer all round our coasts that it is advantageous that well-marked species of even larval forms should have a name under which their occurrences may be chronicled.

Arachnactis bournei, sp. n.

Bourne, J. Mar. Biol. Assoc. (n. s.) i. p. 321.	Plymouth area.	Annually ¹ .	} Described anatomically by van Beneden, Arch. Biol. xi. p. 115.
" " "	Entrance to English Channel.	July 1889.	
McIntosh, Ann. Mag. Nat. Hist. (6) v. p. 306.	St. Andrew's Bay.	June 1890.	} Single specimen re- corded only.
Vallentin, Rep. R. Corn- wall Polyt. Soc. lix.	Falmouth.	Summer, 1890.	
Browne (unpublished).	Port Erin, Isle of Man.	Jan. 1895.	} (Not seen for some years now.—R. V.)
" " "	Valentia Island.	March 1896.	

¹ According to Garstang, March and April are the chief months for *Arachnactis* at Plymouth.

From *A. albida*, which is slender and tapers markedly in late stages, *A. bournei* is recognizable by its fat cylindrical body and sharply rounded end; further, whereas in *A. albida* the union of the swollen bases of the tentacles produces an "oral disk" much greater in diameter than the body (a point better brought out by Sars' than by Vanhöffen's figure), and the tentacles are often many times the length of the body, in *A. bournei* oral disk and body have about the same diameter, and the tentacles are very short. As regards the colouring, my friend Mr. E. T. Browne informs me that he has taken this form on several occasions, and that in colour it is yellowish or brownish all over: it thus presents a great contrast to *A. albida*, which is of a transparent bluish-white, except for the yellowish-brown tips of the tentacles; in older specimens of *albida* the body may also assume a brown tint, but the tentacles remain transparent even in my oldest stages. The mesenteries, in all specimens of *A. bournei* which I have been able to examine, have an extremely short course, extending only about $\frac{1}{4}$ to $\frac{1}{3}$ of the length of the body below the free end of the stomodæum; in *A. albida* they extend to $\frac{1}{2}$ or $\frac{1}{3}$ of this distance even in young specimens, and in older ones some stretch for nearly the whole body-

length. The oldest specimens of this species at present known appear to be the Plymouth specimens with 9 tentacles.

The only other forms referable to the genus at present are (1) *Arachnactis brachiolata*, A. Agassiz¹, obviously a different species from either of the two already described; (2) the larvæ observed by Haime² in the coelenteric cavity of *Cerianthus*, which do not quite resemble either *A. albida* or *A. bournei*; with these latter larvæ may perhaps be identical the forms discovered by Joh. Müller and described by Busch³ from Trieste under the name of *Dianthea nobilis*, which have been suggested by van Beneden to be *Cerianthidan*.

ORIGIN OF THE MESENTERIAL FILAMENT.

A study of the developing mesenteries of *A. albida* has confirmed me in the belief, advocated elsewhere by myself and by others before me on histological grounds, that the thickening at the free edge of the mesentery, commonly known as the mesenterial filament, is ectodermal in origin. The mesenteries in *Cerianthidae*, as has long been known from the researches of A. von Heider⁴, are of two kinds—fertile (generative) and digestive, which generally alternate one with another, and, as he mentions very briefly, carry two different kinds of filaments, which become differentiated about stage G of my specimens.

The filament of a digestive mesentery (fig. 2) is of a type familiar to all students of Anthozoa: it consists of densely packed gland-cells of at least two kinds, among which lie nematocysts in all stages of development; this tissue abuts, quite sharply and without transition, on the undoubtedly endoderm-cells of the mesentery, and agrees exactly in histological detail with the ectoderm of all the stomodæum except that of the sulcus, which has small nematocysts, if any.

The filament of a fertile mesentery (fig. 3) is different from the foregoing both in shape and in histological detail. There is a central groove (often deeper than in the figure) consisting of finely granular gland-cells with very strong cilia; these cells are practically identical with the ectoderm of the sulcus. The groove is flanked by wings containing large gland-cells and nematocysts; next to these come three sets of simpler cells, the nuclei of the first and third set staining very strongly. The last of these three sets lies "unconformably" upon the vacuolated endoderm-cells.

I venture to repeat the suggestion (due first, I believe, to von Heider) that both types of filament are ectodermal downgrowths from the stomodæum along the free edge of the mesentery, on the following grounds:—

1. The histological structure of the chief part of both filaments is

¹ Journ. Bost. Soc. N. H. vii. p. 525 (1863).

² Ann. Sciences naturelles, (4) i. p. 341 (1854).

³ Beob. üb. Anat. u. Entwickl. einiger wirbellosen Seethiere, p. 122: Berlin, 1851, 4to.

⁴ Sitzungsber. d. k.-k. Akad. Wiss. Wien, lxxix. (Math.-nat. Cl.) p. 204.

practically identical with that of the ectoderm of the stomodæum ; even the ectodermal pigment granules, very distinct in borax-carminé preparations on the body and stomodæum, are uniformly present on the filaments, but are not found in the undoubted endoderm.

2. Young mesenteries, which have not yet become united with the stomodæum as far down as its lower free edge, carry only a thickening of obviously endoderm-cells (fig. 4) on their free margins.

3. Mesenteries which have become united with the stomodæum as far down as its lower free edge (except the "directive" mesenteries) carry one or other of the two types of mesenterial filament above described for some distance, but below this filament they show a simple thickening of vacuolated endoderm-cells, of the same character as they carried before they reached the lower edge of the stomodæum (fig. 4); as I interpret it, the ectoderm has grown down along their free margins for some distance, but not as yet for their whole length.

4. The sulcus runs very much further down into the cœlenteron than does any other part of the stomodæum, forming a long groove of the shape indicated in fig. 6. At the point where the ectoderm of the sulcus becomes continuous laterally with the endoderm, the histological structure is practically the same as in the filament of a fertile mesentery (fig. 5).

The only evidence, of which I know, in favour of an endodermal origin of the filament is as follows:—(1) E. B. Wilson¹, in his studies on the development of numerous Alcyonaria, claimed to have shown that the axial (dorsal) filaments were of ectodermal, the remaining six filaments of endodermal, origin. To this one may reply that Alcyonaria are not Actiniaria, although closely allied to them, and that the differentiation of function, with which Wilson showed that the different mesenteries were correlated, does not hold good in the same shape for Actiniaria. (2) The brothers Hertwig² refuse to accept von Heider's suggestion of an ectodermal origin in *Cerianthus* on the ground that in *Sagartia parasitica* the incomplete mesenteries, which do not yet touch on the stomodæum, are provided with a filament similar to that of the complete mesenteries. This is certainly not the case in young *Arachnactis*, and, I may add, the filament of *Sagartia parasitica* seems to be in many respects of an unusual character among Actiniaria. Neither the argument from Alcyonaria nor that from *Sagartia* appears to me to be strong enough to unseat the evidence given above. If these filaments are indeed ectodermal, the boundary between ectoderm and endoderm is obvious enough in the digestive type of mesentery ; but in the fertile type, is probably at the commencement of the vacuolated endoderm-cells, as there occurs at this point what I can only describe, by borrowing a phrase from geology, as an unconformability of strata.

¹ Mittheil. zool. Stat. Neapel, v. 1.

² Die Actinien. Jena, 1879, 8vo. (Jen. Zeitschrift, xiii.)